Quad voltage comparator

LM139A/LM139

FEATURES

- Wide single supply voltage range $2.0V_{DC}$ to $36V_{DC}$ or dual supplies $\pm1.0V_{DC}$ to $\pm18V_{DC}$
- Very low supply current drain (0.8mA) independent of supply voltage (1.0mW/comparator at $5.0V_{DC}$)
- Low input biasing current 25nA
- Low input offset current and offset voltage
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- Low output 250mV at 4mA saturation voltage
- Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems

APPLICATIONS

- A/D converters
- Wide range VCO
- MOS clock generator
- High voltage logic gate
- Multivibrators

DESCRIPTION

The LM139 series consists of four independent precision voltage comparators with an offset voltage specification as low as 2.0mV max for each comparator which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common mode voltage range includes ground, even though operated from a single power supply voltage.

The LM139 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the LM139 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

ORDERING INFORMATION

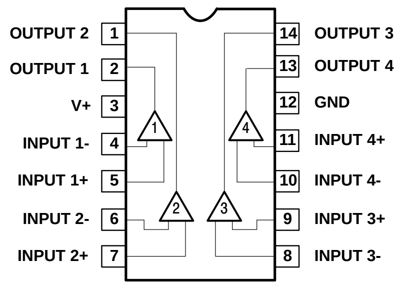
DESCRIPTION	ORDER CODE	PACKAGE DESIGNATOR*
14-Pin Ceramic DIP	LM139/BCA	GDIP1-T14
14-Pin Ceramic DIP	LM139A/BCA	GDIP1-T14

* MIL-STD 1835 or Appendix A of 1995 Military Data Handbook

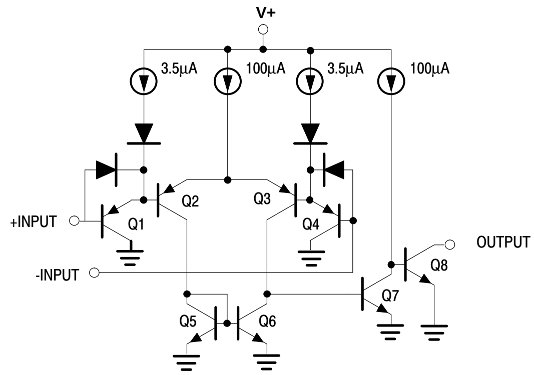
ABSOLUTE MAXIMUM RATINGS[10]

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	36 or ±18	V
V_{DIFF}	Differential input voltage	36	V
V_{IN}	Input voltage	-0.3 to +36	V
P_D	Power dissipation[1]	900	mW
I_{SC}	Output short circuit to ground[3]	Continuous	
I_{IN}	Input current ($V_{IN} < -0.3V_{DC}$)[4]	50	mA
T_{STG}	Storage temperature range	-65 to +150	°C

PIN CONFIGURATION



EQUIVALENT CIRCUIT (One Comparator Only)



DC ELECTRICAL CHARACTERISTICS

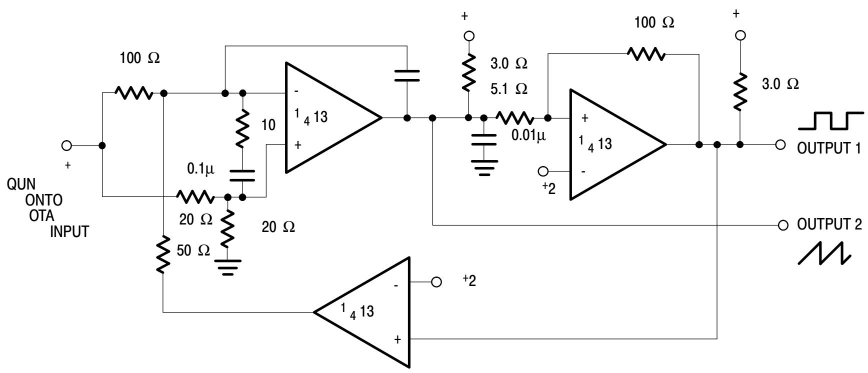
V+ = +5V, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	T_{amb} = +25°C			T_{amb} = -55°C, +125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage[6]	LM139A (only)		1.0	2.0			4.0	mV
V_{IO}	Input offset voltage[6]	LM139 (only)		2.0	5.0			9	mV
V_{ICR}	Common mode voltage range[7]		0		V+ -1.5	0		V+ -2.0	V
V_{IDR}	Differential input voltage[5]	Keep all $V_{IN} \geq 0V$ (or V- if need)			V+			V+	V
I_{IB}	Input bias current[6]	$I_{IN(+)}$ or $I_{IN(-)}$ with output in linear range		25	100			300	nA
I_{IO}	Input offset current	$I_{IN(+)} - I_{IN(-)}$		3.0	25			100	nA
I_{OL}	Output sink current	$V_{IN(-)} \geq 1V$, $V_{IN}(+) = 0V$, $V_O \leq 1.5V$	6.0	16		4.0			mA
I_{OH}	Output leakage current	$V_{IN(+)} \geq 1V$, $V_{IN}(-) = 0V$, $V_O = 5V$		0.1					nA
		$V \leq 30V$			1.0			1.0	µA
I_{CC}	Supply current	V+ = 30V, $R_L = \infty$		0.8	2.0			3.0	mA
A_V	Voltage gain	R_L = 15kΩ, V+ = 15V	50	200		25			V/mV
V_{OL}	Saturation voltage	$V_{IN(-)} \geq 1V_{DC}$, $V_{IN(+)} = 0$, $I_{SINK} \leq 4mA$		250	400			700	mV
t_{LSR}	Large signal response time	V_{IN} = TTL logic swing, V_{REF} = 1.4V, V_{RL} = 5V, R_L = 5.1kΩ		300					ns
t_R	Response time[9]	V_{RL} = 5V, R_L = 5.1kΩ		1.3					µs
PSRR	Power supply rejection ratio	V+ = 5V to 30V – LM139	65			65			dB
PSRR	Power supply rejection ratio	V+ = 5V to 30V – LM139A	70			70			dB
CMRR	Common mode rejection ratio	$R_L \geq$ 15kΩ, V+ = 30V, V_{CM} = 0V to 28.5V, LM139 25°C	65						dB
		LM139 temp, V_{CM} = 0V to 28V				65			dB
CMRR	Common mode rejection ratio	$R_L \geq$ 15kΩ, V+ = 30V, V_{CM} = 0V to 28.5V, LM139A 25°C	70						dB
		LM139A temp, V_{CM} = 28.0V				70			dB

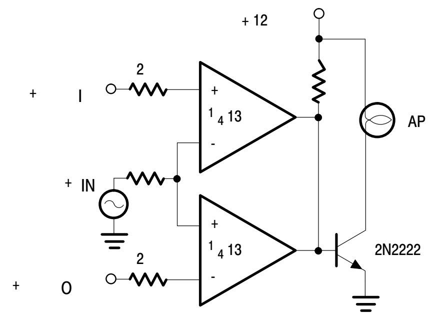
NOTES:

1. Operation beyond the limits of this table may impair the useful life of the device.
2. The LM139/139A must be derated on a 150°C max. junction temperature. The low power dissipation and the "On-Off" characteristics of the outputs keep the chip dissipation very small ($P_D \leq$100mW), provided the output transistors are allowed to saturate.
3. Short circuits from the output to V+ can cause excessive heating and eventual destruction. The max. output current is approximately 20mA independent of the magnitude of V+.
4. This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the V+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than -0.3V_{DC}.
5. Positive excursions of input voltage may exceed the power supply level by 17V. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than -0.3V_{DC} (or 0.3V_{DC} below the magnitude of the negative power supply, if used).
6. At output switch point, $V_O \cong 1.4V_{DC}$, R_S = 100Ω with V+ from 5V_{DC} to 30V_{DC}, over the full input common-mode range (0V_{DC} to V+ -1.5V_{DC}).
7. The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. the upper end of the common-mode voltage range is V+ -1.5V, but either or both inputs can go to 30V_{DC} without damage.
8. The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
9. The response time specified is for a 100mV input step with a 5mV overdrive. For larger overdrive signals, 300ns can be obtained. See Typical Performance Characteristics section.
10. Operation beyond the limits of this table may impair the useful life of the device.

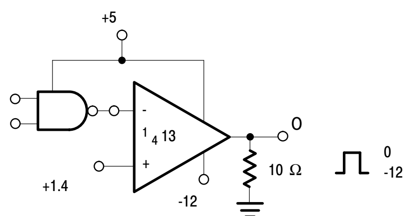
TYPICAL APPLICATIONS



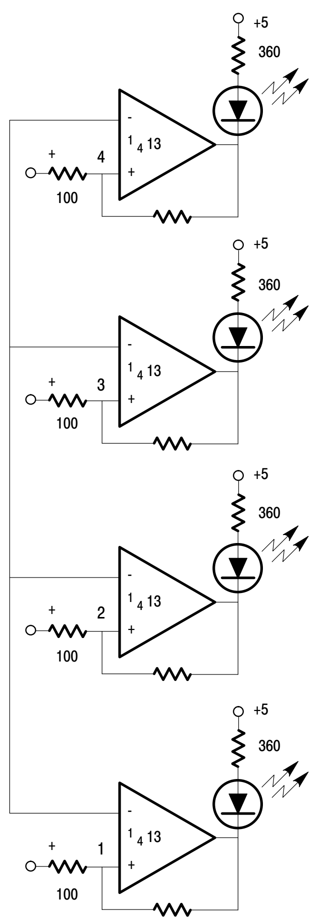
Two-Decade High-Frequency VCO



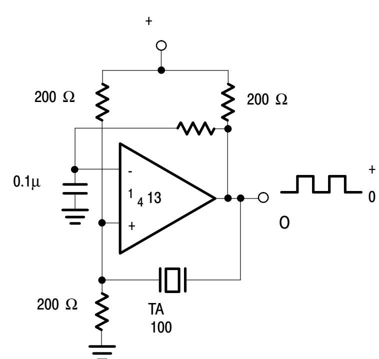
Limit Comparator



TTL-to-MOS Logic Converter



Visible Voltage Indicator

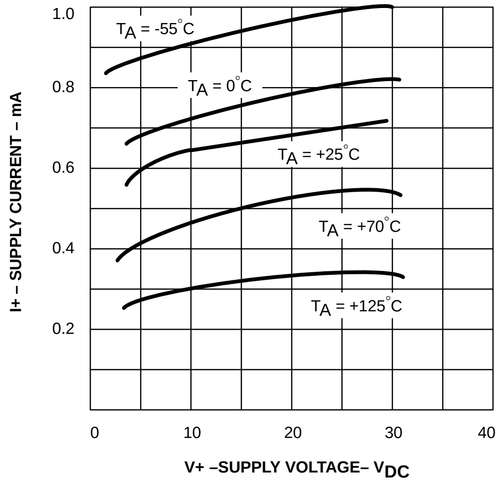


Crystal-Controlled Oscillator

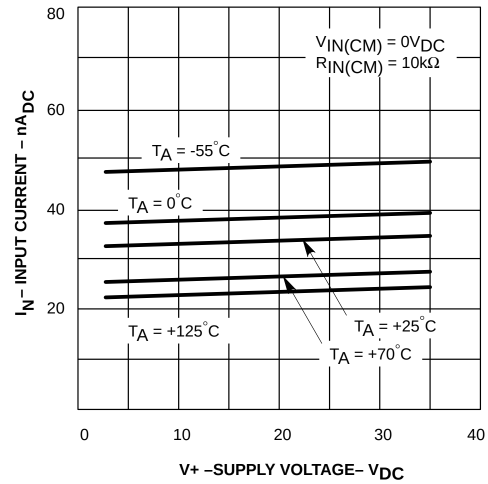
NOTE: I .

TYPICAL PERFORMANCE CHARACTERISTICS

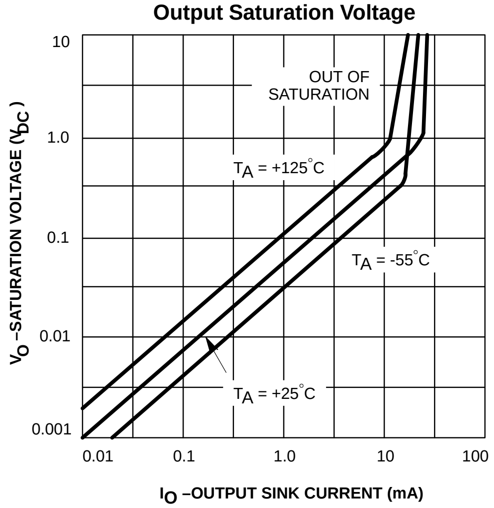
Supply Current



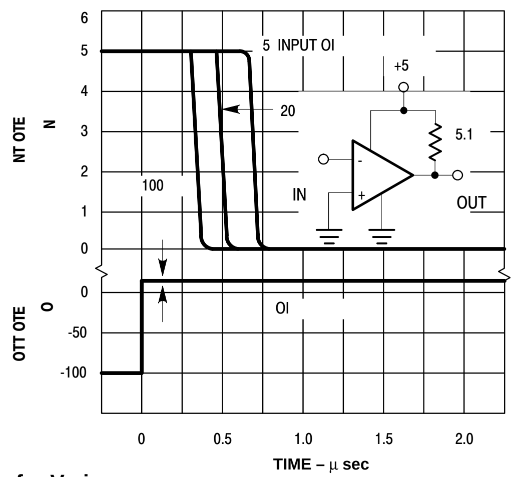
Input Current



Output Saturation Voltage



Response Time for Various Input Overdrives – Negative Transition



Response Time for Various Input Overdrives – Positive Transition

